R E M A R K S

Reconsideration of this application, as amended, is respectfully requested.

THE CLAIMS

Independent claim 1 has been amended to recite that the injection section injects and supplies a material into the micro flow path by an inkjet head, and that the material includes a liquid oxidizing agent to cause one of: (i) an oxidation reaction which oxidizes carbon monoxide in a fuel including hydrogen in the micro flow path, and (ii) a combustion reaction which combusts a combustion fuel with the liquid oxidizing agent.

Independent claim 16 has been amended in a similar manner to recite a micro reactor which causes one of: (i) an oxidation reaction which oxidizes carbon monoxide with a liquid oxidizing agent in a furnace, wherein the carbon monoxide is in a fuel including hydrogen, and (ii) a combustion reaction which combusts a combustion fuel with the liquid oxidizing agent in the furnace, as well as to recite that the liquid oxidizing agent is supplied into the furnace by an inkjet head.

Still further, claims 1, 3-6, 8, 10, 11, 13, 15, 16 and 18 have been amended to make some minor grammatical improvements and to correct some minor antecedent basis problems so as to put them

in better form for issuance in a U.S. patent. In particular, it is noted that the claim 16 has also been amended to correct the informality pointed out by the Examiner in item 1 on page 2 of the Office Action, and

No new matter has been added, and it is respectfully requested that the amendments be approved and entered.

THE PRIOR ART REJECTIONS

Claims 1-10 were rejected under 35 USC 102 as being anticipated by JP 2001-228159 ("Kiguchi" - referred to by the Examiner as "Hiroshi"); claims 16 and 18 were rejected under 35 USC 102 as being anticipated by US 2003/0134163 ("Markoski et al"); and claims 11-15 and 17 were rejected under 35 USC 103 as being unpatentable in view of various combinations of Kicughi, Markoski et al, USP 6,777,118 ("Shioya"), USP 6,969,506 ("Tonkovich et al"), and US 2002/0176804 ("Strand et al"). These rejections, however, are respectfully traversed with respect to the claims as amended hereinabove.

According to the present invention as recited in amended independent claim 1, a chemical reactor is provided which includes a pair of substrates joined to each other, a micro flow path provided between the pair of substrates, and an injection section which injects and supplies a material into the micro flow

path by an inkjet head, wherein the material includes a liquid oxidizing agent to cause one of: (i) an oxidation reaction which oxidizes carbon monoxide in a fuel including hydrogen in the micro flow path, and (ii) a combustion reaction which combusts a combustion fuel with the liquid oxidizing agent.

Similarly, according to the present invention as recited in amended independent claim 16, a chemical reactor is provided which comprises a micro reactor which causes one of: (i) an oxidation reaction which oxidizes carbon monoxide with a liquid oxidizing agent in a furnace, wherein the carbon monoxide is in a fuel including hydrogen, and (ii) a combustion reaction which combusts a combustion fuel with the liquid oxidizing agent in the furnace, and wherein the liquid oxidizing agent is supplied into the furnace by an inkjet head.

In conventional chemical reactors, when air is used as an oxidizing agent to oxidize carbon monoxide in a fuel including hydrogen in a flow path, since the oxygen concentration in atmospheric air accounts for only around 20%, a gas whose volume is roughly five times as high as that of a necessary amount of oxygen must be heated to a temperature required for a chemical reaction. This causes a significant decrease of the hydrogen concentration in the fuel. See the disclosure in the specification at page 2, lines 19-25.

By contrast, according to the claimed present invention, since a liquid oxidizing agent is used, the effective amount of the oxidizing agent per unit volume is larger than in the case of conventional chemical reactors in which atmospheric air is used. In addition, with the structure of the claimed present invention whereby an ink jet head is used to supply the liquid oxidizing agent, it is easy to control supply of the liquid oxidizing agent in small amounts in accordance with the minimum supply amount required. Thus, with the structure of the claimed present invention, the hydrogen concentration can be prevented from being significantly decreased.

Moreover, in conventional chemical reactors, when atmospheric air is used as an oxidizing agent, in a reaction in which heat is generated such as a combustion reaction, the nitrogen in the air which does not contribute to combustion must also be heated. As a result, the efficiency of combustion heat is inhibited.

However, according to the claimed present invention, since a liquid oxidizing agent is used, the effective amount of the oxidizing agent per unit volume is larger than gas, and combustion heat can be utilized efficiently.

With respect to the cited prior art, Kiguchi discloses that a piezoelectric element 18 of an inkjet head supplies a sample 40

filled in tank 32 into channel 14 (see paragraph [0021] and Fig. 4). In addition, Kiguchi discloses that liquid is ejected from liquid ejection head 30 of the inkjet head to a cavity 21 which is filled with the sample 40 (see paragraph [0022] and Fig. 5).

It is respectfully submitted, however, that Kiguchi does not disclose, teach or suggest the features of the chemical reactor of the claimed present invention whereby a liquid oxidizing agent is supplied by an inkjet head to cause one of: (i) an oxidation reaction which oxidizes carbon monoxide in a fuel including hydrogen, and (ii) a combustion reaction which combusts a combustion fuel with the liquid oxidizing agent, as recited in amended independent claims 1 and 16.

With respect to Markoski et al, it is noted that this reference discloses supplying an aqueous solution including hydrogen peroxide to an oxidant input 24 of a fuel cell 20 (see paragraph [0050] and Fig. 7). It is respectfully pointed out, however, that since the aqueous solution in Markoski et al is circulated by an oxidant pump and reused, it is not necessary to control supply of the aqueous solution by the inkjet head in small amounts as in the case of the claimed present invention. In addition, since the circulation of Markoski et al is a closed system, little heat is released, and unlike as in the chemical

reactor of the claimed present invention, Markoski et al does not have the problem of heat efficiency being decreased due to absorption of heat from a non-oxidizing agent (nitrogen) of a wasteful volume by intake of atmospheric air.

It is respectfully submitted that neither Kiguchi nor Markoski et al recognizes the problem of heat efficiency being decreased because of intake of atmospheric air which includes wasteful non-oxidizing agents, and it is respectfully submitted that neither of these references discloses applying a liquid oxidizing agent in an oxidation reaction or a combustion reaction to solve the problem, nor controlling the fluid oxidizing agent in small amounts by an inkjet head.

Accordingly, it is respectfully submitted that Kiguchi and Markoski et al fail to disclose, teach or suggest the features of the chemical reactor of the claimed present invention whereby a liquid oxidizing agent is supplied by an inkjet head to cause one of: (i) an oxidation reaction which oxidizes carbon monoxide in a fuel including hydrogen, and (ii) a combustion reaction which combusts a combustion fuel with the liquid oxidizing agent, as recited in amended independent claims 1 and 16.

It is respectfully pointed out, moreover, that since Kiguchi does not disclose anything about applying an oxidizing agent for oxidation in a fuel cell, it will not be obvious to one of

ordinary skill in the art to apply the liquid ejection head of Kiguchi to the oxidizing agent supplying means of the fuel cell of Markoski et al.

In any event, it is respectfully submitted that even if the liquid ejection head of Kiguchi could be applied to the oxidizing agent supplying means of the fuel cell of Markoski et al, such combination would still not achieve or render obvious the structure of the claimed present invention.

With respect to the other cited prior art references, it is noted that Shioya does not disclose applying a fluid oxidizing agent to an oxidizing reaction and a combustion reaction, nor controlling the fluid oxidizing agent in small amounts by the inkjet head.

Tonkovich et al discloses heat exchange in which heat of an exothermic reaction in microchannels is utilized in combustion close to an endothermic reaction (see column 1, lines 50-59 and in Fig. 8). However, Tonkovich et al does not disclose applying a fluid oxidizing agent to an oxidizing reaction and a combustion reaction, nor controlling the fluid oxidizing agent in small amounts by the inkjet head.

Blanchard discloses micro-pumps which squeeze out liquid to a microchannel. However, Blanchard does not disclose applying a fluid oxidizing agent to an oxidizing reaction and a combustion

reaction, nor controlling the fluid oxidizing agent in small amounts by an inkjet head.

In view of the foregoing, it is respectfully submitted that the present invention as recited in amended independent claims 1 and 16, as well as claims 2-6, 8, 10-15 and 18 respectively depending therefrom, clearly patentably distinguishes over all of the cited references, taken singly or in any combination, under 35 USC 102 as well as under 35 USC 103.

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Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned for prompt action.

Respectfully submitted,

/Douglas Holtz/

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